REMARKS

Claims 1, 10, 11, 15, 20, 22, 29, 32, 33, 43, 44, 48, 49, 53, 60, 62, 67, 68 and 71 are amended. Claims 9, 23, 42 and 59 are currently canceled without prejudice. Claims 24-27 and 63-66 were previously canceled without prejudice. New claims 78-82 are added. No new matter is added. See, e.g., Figure 2 (etching silica disk); claim 80; para. 41; claims 81 and 82). Claims 1-8, 10-22, 28-41, 43-58, 60-62, and 67-82 are currently pending in the application. Reconsideration and allowance of the application, as amended, are respectfully requested.

I. Allowable Claims

Applicants kindly acknowledge that page 11 of the Office action states that dependent claims 23 and 59 would be allowable if rewritten in independent form to include the element and limitations of respective independent claims and to address the objection of page 2 of the Office action.

New claims 78 and 79 are independent claims that address the objection and recite a limitation directed to a biotinylated surface. Applicants respectfully submit that claims 78 and 79 are allowable.

II. Objections Addressed

Claim 53 is amended to depend from claim 52. Claims 11 and 44 are amended to replace "at least about 10 micrometers" with "about 10 micrometers to about 30 micrometers." (See, e.g., para. 28). Applicants respectfully request that the objections concerning claims 11, 44 and 53 be withdrawn.

III. Claims 1 and 29 Are Novel Over McCall

Independent claims 1 and 29 are rejected under 35 U.S.C. §102(b) as being anticipated by U.S. Patent No. 5,343,490 to McCall ("McCall"). A claim is anticipated only if each and every element as set forth in the claim is found, either expressly or inherently described, in a single prior art reference. MPEP § 2131 (emphasis added). The identical invention must be shown in as complete detail as is contained in the claim. MPEP § 2131. Applicants respectfully traverse the rejection and submit the following remarks to expedite prosecution of the application to allowance.

McCall fails to disclose or suggest "an ultra-high Q micro-cavity having a Q value of at least 1.00 x 10^8" as recited in claims 1 and 29. The Office action refers to Figure 7 and col. 7, lines 18-50 of McCall to support the rejection. The cited sections of McCall, however, are silent as to Q value, and do not otherwise suggest what the Q value might be, much less an ultra-high Q value of at least 1.00 x 10^8.

Instead, McCall refers to changing cavity Q (col. 2, lines 43-44), a "Q change" as in on/off operation of a transistor (col. 5, lines 44-50) and a modulating or controlling inputs to alter the cavity resonance frequency or its Q value (col. 5, line 18). The very limited description of Q values in McCall, however, does not disclose or suggest "ultra-high Q value," and does not disclose or suggest an ultra-high Q value micro-cavity "having a Q value of at least 1.00 x 10^8" as recited in claims 1 and 29.

At best, McCall discloses that the cavity has a Q value (as is known in the art), but one can only guess as to the Q value described in col. 7, lines 18-51. Applicants note, however, that such conjecture is not proper since "the fact that a certain result or characteristic may occur or be present in the prior art is not sufficient to establish the inherency of that result or characteristic." MPEP § 2112 (emphasis added), citing *In re Rijckaert*, 9 F.3d 1531, 1524 (Fed. Cir. 1993) (reversed rejection based on inherency assertion). Rather, extrinsic evidence must make clear that the missing descriptive matter is necessarily present in the thing described in the reference... MPEP§ 2112 (emphasis added), citing *In re Robertson*, 169 F.3d 743, 745 (Fed. Cir. 1999). The mere fact that a certain thing may result from a given set of circumstances in not sufficient. Further, "in relying upon the theory of inherency, the examiner must provide a basis in fact and/or technical reasoning to reasonably support the determination that the allegedly inherent characteristic necessarily flows from the teachings of the applied prior art." MPEP § 2112, citing *Ex parte Levy*, 17 USPQ2d 1461, 1644 (Bd. Pat. App. & Inter. 1990). The Office action has not demonstrated that the structure described in McCall necessarily has an ultra high Q value of at least 1.00 x 10^8 and has presented no extrinsic evidence to support this assertion.

Further, McCall fails to disclose or suggest "a substrate that supports the optical material, wherein the optical material is meltable by heat so that a periphery of the optical material adheres to itself" to form an ultra-high Q micro-cavity having a Q value of at least 1.00 x 10^8 as recited in amended claim 29. In contrast, col. 7, lines 18-51 (Figure 7) cited in the Office action, explain that the cavity is fabricated by "photolithographic techniques" that are used "to pattern the disks..." Thus, McCall is deficient relative to Claim 29.

In view of the above remarks, Applicants respectfully request that the rejection of independent claims 1 and 29 under §102(b) be withdrawn.

IV. Claims 2, 4-8, 13, 15, 22, 30, 34, 36-41, 45, 47, 49 and 62 Are Novel Over McCall

Dependent claims 2, 4-8, 13, 15, 22, 30, 34, 36-41, 45, 47, 49 and 62 are rejected under 35 U.S.C. §102(b) as being anticipated by McCall. These claims incorporate all of the elements and limitations of respective independent claims 1 and 29 and add novel and non-obvious limitations thereto. Accordingly, these dependent claims are novel over McCall, and Applicants respectfully request that the rejection of claims dependent claims 2, 4-8, 13, 15, 22, 30, 34, 36-41, 45, 47, 49 and 62 under 35 U.S.C. §102(b) be withdrawn. MPEP §2143.03 (if an independent claim is non-obvious, then a claim that depends from the independent claim is also non-obvious), citing *In re Fine*, 837 F.2d 1071 (Fed. Cir. 1988).

Further, McCall does not disclose or suggest the optical material that is used to form an ultra-high Q micro-cavity "comprising silica" as recited in claim 30. The Office action refers to col. 6, line 68 of McCall, however, this section discloses that silica is a "spacer" or "barrier" material.

McCall also fails to disclose or suggest "a size of the ultra-high Q micro-cavity is limited by a size of a top surface of the substrate" as recited in claim 41. The subject application explains that molten optical material that forms the micro-cavity shrinks and collapses upon itself until the inner surface of the disk shrinks around the outer portion of the top surface of the silicon pillar. Thus, the micro-cavity is "self-quenching" and the size of the ultra-high Q micro-cavity is limited by a size of the top surface of the substrate. The Office action refers to Figure 7 of McCall. Column 7, lines 18-51 (the corresponding specification section of McCall), however, disclose photolithographic techniques to pattern disks with different diameters. Thus, the size of the cavity described in McCall is controlled by photolithographic techniques rather than being limited by the size of the top surface of the substrate.

In view of the above remarks, Applicants respectfully request that the rejection of dependent claims 2, 4-8, 13, 15, 22, 30, 34, 36-41, 45, 47, 49 and 62 under §102(b) be withdrawn.

V. Claims 3, 12, 14, 28, 31, 35, 46 and 58 Are Patentable Over McCall and Kawachi

Dependent claims 3, 12, 14, 28, 31, 35, 46, and 58 are rejected under 35 U.S.C. §103(a) as being unpatentable over McCall in view of "Silica Waveguides On Silicon and Their Application to Integrated-Optic Components" by Kawachi ("Kawachi").

Under 35 U.S.C. §103(a), to establish a *prima facie* case of obviousness of a claim, all of the claim limitations must be taught or suggested, and all words in a claim must be considered in judging the patentability of that claim against Weaver. MPEP §§2143; 2143.03, citing *In re Royka*, 490 F.2d 981 (CCPA 1974). In addition to this "all elements" rule, there must be some suggestion or motivation to combine the references, and a reasonable expectation of success. MPEP §§2143.01-2143.03, citing *In re Vaeck*, 947 F.2d 488 (Fed. Cir. 1991). The mere fact that a reference can be modified does not render the resultant modification obvious unless the reference also suggests the desirability of the modification. MPEP § 2143.01, citing *In re Mills*, 916 F.2d 680 (Fed. Cir. 1990). Further, if a proposed modification would render the prior art invention being modified unsatisfactory for its intended purpose, then there is no suggestion or motivation to make the proposed modification.); MPEP §2143.01 (*In re Gordon*, 733 F.2d 900 (Fed. Cir. 1984). It is also improper to modify or combine references where the references teach away from the modification or combination. MPEP §2146; *In re Grasselli*, 713 F.2d 731, 743 (Fed. Cir. 1983). Applicants respectfully submit that the cited references cannot support the rejection in view of these requirements.

Initially, Kawachi does not cure the deficiencies of McCall. Thus, assuming *arguendo* the asserted combination were made, the combination would nevertheless fail to disclose each and every limitation of the claims, and the rejection under §103(a) cannot stand. MPEP §§2143; 2143.03, citing *In re Royka*, 490 F.2d 981 (CCPA 1974). Dependent claims 3, 12, 14, 28, 31, 35, 46, and 58, which incorporate all of the elements and limitations of respective independent claims 1 and 29 and add novel and non-obvious limitations thereto, are also patentable over McCall and Kawachi. MPEP §2143.03 (if an independent claim is non-obvious, then a claim that depends from the independent claim is also non-obvious), citing *In re Fine*, 837 F.2d 1071 (Fed. Cir. 1988).

The Office action asserts that page 391 of Kawachi discloses that ultra-high Q silica micro-cavities are well known. However, page 391 makes no reference to Q value and does not disclose suggest ultra-high Q values being at least 1.00×10^8. These deficiencies are clear when one considers that claims 1 and 29 reciting limitations directed to portions of the substrate located below the ultra-high Q micro-cavity being removed to form a pillar, the pillar supporting the ultra-high Q micro-cavity.

Nevertheless, Kawachi is not analogous art since McCall relates to disc-shaped elements (McCall, Abstract) and Kawachi relates to optical fibers. As is known in the art, fabrication of disc-shaped structures is substantially different compared to fabrication of fiber structures, and these structures have different optical properties. Simply because Kawachi may disclose certain optical properties of fibers does not mean that such properties can be achieved in different structures, and the Office action has presented no reasoning or extrinsic evidence to support this assertion.

Further, Kawachi describes making fibers by channel wave guide technologies, whereas the micro-cavities of the subject application are supported by a substrate or pillar, and the periphery of an optical material is heated to form an ultra-high a micro-cavity. Thus, Kawachi is not relevant given these substantially different structures and methods of fabrication.

In view of the above remarks, Applicants respectfully request that the rejection of dependent claims 3, 12, 14, 28, 31, 35, 46 and 58 under §103(a) be withdrawn.

VI. Claims 16-18, 50 and 51 Are Patentable Over McCall and Chan

Dependent claims 16-18, 50 and 51 are rejected under 35 U.S.C. §103(a) as being unpatentable over McCall over "Gas Phase Pulse Etching of Silicon For MEMS With Xenon Difuoride" by Chan ("Chan"). Chan is cited for the limited purposes of assertedly disclosing a xenon difluouride gas etchant and a silicon substrate.

Chan does not cure the deficiencies of McCall. Thus, assuming *arguendo* the asserted combination were made, the combination fails to disclose or suggest each and every limitation of the claims, and the rejection under §103(a) cannot stand MPEP §2143.03. Dependent claims 16-18, 50 and 51 add novel and non-obvious limitations to claims 1 and 29 and are patentable over McCall in view of Chan. MPEP §2143.03 (if an independent claim is non-obvious, then a claim that depends from the independent claim is also non-obvious), citing *In re Fine*, 837 F.2d 1071 (Fed. Cir. 1988).

VII. Claims 19 and 48 Are Patentable Over McCall in view of Gayral

Dependent claims 19 and 48 are rejected under 35 U.S.C. §103(a) as being unpatentable over McCall in view of "High Q Wet-Etched GaAs Microdisks Containing InAs Quantum Boxes" by Gayral ("Gayral"). Gayral is cited for the limited purpose of assertedly disclosing a tapered shape.

Gayral does not cure the deficiencies of McCall. Thus, assuming *arguendo* that the asserted combination were made, the combination fails to disclose or suggest each and every limitation of the claims. MPEP §2143.03. Dependent claims 19 and 48 add novel and non-obvious limitations to claims 1 and 29 and are patentable over McCall in view of Chan. MPEP §2143.03 (if an independent claim is non-obvious, then a claim that depends from the independent claim is also non-obvious), citing *In re Fine*, 837 F.2d 1071 (Fed. Cir. 1988).

VIII. Claims 20, 21, 60 and 61 Are Patentable Over McCall in view of Chu

Dependent claims 20, 21, 60 and 61 are rejected under 35 U.S.C. §103(a) as being unpatentable over McCall in view of Chu. Chu is cited for the limited purpose of assertedly disclosing a micro-cavity having a rare earth dopant.

Chu does not cure the deficiencies of McCall. Thus, assuming *arguendo* the asserted combinations were made, the combination fails to disclose each and every limitation of the claims. MPEP §2143.03. Dependent claims 20, 21, 60 and 61 add novel and non-obvious limitations to claims 1 and 29 and are patentable over McCall in view of Chu. MPEP §2143.03 (if an independent claim is non-obvious, then a claim that depends from the independent claim is also non-obvious), citing *In re Fine*, 837 F.2d 1071 (Fed. Cir. 1988).

IX. Claims 9-11, 32, 33, 42-44 and 52-57 Are Patentable Over McCall in view of Klitzing

Dependent claims 9-11, 32, 33, 42-44 and 52-57 are are rejected under 35 U.S.C. §103(a) as being unpatentable over McCall in view of "Tunable Whispering Gallery Modes For Spectroscopy and CQED Experiments" by Klitzing ("Klitzing"). Klitzing is cited for the limited purpose of assertedly disclosing a Q value of 3 x 10^9 and that it would have been obvious to use higher Q values in the device described in McCall.

Klitzing does not cure the deficiencies of McCall. Thus, assuming *arguendo* the asserted combination were made the combination fails to disclose each and every limitation of the claims. Dependent claims 9-11, 32, 33, 42-44 and 52-57 add novel and non-obvious limitations to claims 1 and 29 and are patentable over McCall in view of Klitzing. MPEP §2143.03 (if an independent claim is non-obvious, then a claim that depends from the independent claim is also non-obvious), citing *In re Fine*, 837 F.2d 1071 (Fed. Cir. 1988).

Additionally, Klizting discloses Q value of spheres, not micro-cavities having portions of a substrate located below an ultra-high Q micro-cavity removed to form a pillar, the pillar supporting the ultra-high Q micro-cavity. Further, Klizting does not disclose an optical material being meltable by heat so that a periphery of the optical material adheres to itself to form an ultra-high Q micro-cavity as recited in claim 29.

These substantial differences are noted by Klitzing. For example, page 142, para. 3 distinguishes "microdisks and pillars" from "microspheres." Further, these substantial structural differences are noted in the subject application. See, paras. 0004-0007 (describing known micro-spheres). *Cf.*, Figure 1B (illustrating pillar/micro-cavity configuration of claims of subject application).

Correspondingly, simply because Klitzing may disclose a particular Q value for a spherical micro-cavity does not mean that such a Q value can be achieved in other different structures given the particular manufacturing techniques and attributes of the resulting different structures. Indeed, Klitzing notes the deficiencies of Q values of known microdisks and pillars structures. For example, Klitzing explains "semiconductor microdisks and pillars can only operate in the low-Q regime..." whereas "microspheres provide a unique combination of small mode resonators with ultra high Q values." (Klitzing, p. 14.2) (emphasis added). Thus, in addition to acknowledging that embodiments recited in Applicants' claims 1 and 29 have not existed previously, Klitzing teaches away from claims 1 and 29, which recite pillar and micro-cavity limitations.

X. Claim 67 is Patentable Over McCall

Independent claim 67 is rejected under 35 U.S.C. §103(a) as being unpatentable over McCall. Applicants respectfully submit that the above remarks relevant to the limitations of claim 67 overcome the rejection. McCall does not disclose or suggest "an ultra-high Q torid-shaped planar silica micro-cavity having a Q value of at least 1.00 x 10^8. Figure 5 of McCall illustrates a "donut-shaped" cavity, however, the corresponding description (col. 10, line 61 - col. 6) does not otherwise disclose or suggest Q value as recited in Applicants' claims. Further, McCall does not disclose or suggest why isotopric etching is desirable.

Thus, the Office action's assertion is inconsistent with the reference failing to suggest the desirability of the modification since mere fact that McCall can be modified does not render the resultant modification obvious unless McCall also suggests the desirability of the modification. MPEP §2143.01, citing *In re Mills*, 916 F.2d 680 (Fed. Cir. 1990). Thus, the rejection under §103(a) of claim 67 should be withdrawn.

XI. Claims 68, 69 and 71 Are Novel Over Chu

Independent claims 68 and dependent claims 69 and 71 are rejected under 35 U.S.C. §102(b) as being anticipated by "Observation of Enhanced Photoluminescence In Erbium-Doped Semiconductor Microdisk Resonator" by Chu ("Chu").

Chu does not disclose or suggest "heating a periphery of the optical material so that the periphery melts and adheres to itself" as recited in claim 68. Instead, Chu explains the "AlGaP pedestal layer was grown by gas source molecular beam epitaxy (GSMBE) and the Er-doped GaP disk layer was grown by atmospheric pressure metalorganic vapor phase epitaxy (MOVPE). (Page 2843, col. 2, para. 2 (emphasis added). Moreover, Chu explains a "standard photolithographic technique was used to fabricate the Er-doped GaP microdisk resonator with a 10-20 μm diameter." (Chu, p. 2844, col. 1 (emphasis added)). Chu, therefore, describes techniques that are not related to processing involving heating, melting and adhering as recited in claim 68.

Additionally, Chu does not disclose or suggest heating a periphery of the optical material so that the periphery melts and adheres to itself "to form the ultra-high Q micro-cavity having a Q value of at least 1.00 x 10^8 as recited in claim 68. In fact, Chu does not disclose specific Q values. Rather, Chu explains that a "high Q cavity can store photons leading to an enhancement of the light intensity in the cavity." (Chu, Page 2845, col. 2). Other than this very limited and non-specific reference to high Q value, there is no disclosure of Q values and no disclosure of Q values of at least 1.00 x 10^8.

Further, Q values of at least 1.00 x 10^8 are not inherently disclosed by Chu since there is no clear disclosure that makes it clear that the missing Q values of at least 1.00 x 10^8 are necessary present and necessarily flow from Chu. As discussed above, "the fact that a certain result or characteristic may occur or be present in the prior art is not sufficient to establish the inherency of that result or characteristic." MPEP § 2112 (emphasis added), citing *In re Rijckaert*, 9 F.3d 1531, 1524 (Fed. Cir. 1993) (reversed rejection based on inherency assertion). Rather, "extrinsic evidence 'must make clear that the missing descriptive matter is necessarily present in the thing described in the reference..." MPEP§ 2112 (emphasis added), citing *In re Robertson*, 169 F.3d 743, 745 (Fed. Cir. 1999). The mere fact that a certain thing may result from a given set of circumstances in not sufficient. *Id.* Further, "in relying upon the theory of inherency, the examiner must provide a basis in fact and/or technical reasoning to reasonably support the determination that the allegedly inherent characteristic necessarily flows from the teachings of the applied prior art." MPEP § 2112, citing *Ex parte Levy*, 17 USPQ2d 1461, 1644 (Bd. Pat. App. & Inter. 1990). The very limited disclosure of Chu, therefore, cannot support the rejection of claim 68.

Dependent claims 69 and 71 incorporate all of the elements and limitations of independent claim 68 and add novel and non-obvious limitations thereto. Accordingly, these dependent claims are patentable over Chu. MPEP §2143.03 (if an independent claim is non-obvious, then a claim that depends from the independent claim is also non-obvious), citing *In re Fine*, 837 F.2d 1071 (Fed. Cir. 1988).

Further, Chu fails to disclose or suggest "providing a silicon substrate" as recite in claim 69. The Office action refers to pages 2843-2844, but Chu explains that the microdisk resonator includes an AlGaP pedestal layer and that the disk layer is an Er-doped GaP disk layer. Specifically, Chu explains the "structure for the Er-doped GaP microdisk resonator consists of a pedestal layer and a disk layer.... The AlGaP pedestal layer was grown y gas source molecular beam epitaxy (GSMBE) and the Er-doped GaP disk layer was grown by atmospheric pressure metalorganic vapor phase epitaxy (MOVPE). (Chu, p. 2843, col. 2)

Chu also fails to disclose or suggest "providing silica (SiO_2)" optical material as recited in claim 71. Rather, as discussed above, Chu explains that that the disk layer is an Er-doped GaP disk layer. (Chu, p. 2843, col. 2)

Accordingly, Applicants respectfully request that the rejection of claims 68, 69 and 71 under §102(b) be withdrawn.

XII. Claim 70 Is Patentable Over Chu in view of Chan

Dependent claim 70 is rejected under 35 U.S.C. §103(a) as being unpatentable over Chu in view of Chan. Chan, however, does not cure the deficiencies of Chu, as discussed above. Thus, the asserted combination fails to disclose each and every limitation of claim 70 and dependent claim 70 is patentable over Chu in view of Chan. MPEP §2143.03 (if an independent claim is non-obvious, then a claim that depends from the independent claim is also non-obvious), citing *In re Fine*, 837 F.2d 1071 (Fed. Cir. 1988).

XIII. Claims 72-77 Are Patentable Over Chu in view of Klitzing

Dependent claims 72-77 are rejected under 35 U.S.C. §103(a) as being unpatentable over Chu in view of Klitzing. Klitzing, however, does not cure the deficiencies of Chu. The deficiencies of Klitzing are discussed above. Thus, the asserted combination fails to disclose each and every limitation of claims 72-77, and dependent claims 72-77 are patentable over Chu in view of Klitzing. MPEP §2143.03 (if an independent claim is non-obvious, then a claim that depends from the independent claim is also non-obvious), citing *In re Fine*, 837 F.2d 1071 (Fed. Cir. 1988).

XIV. Claims 72-77 Are Patentable in view of Chan

Claims 80-82 depend from respective independent claims 68, 1 and 29 and add novel and non-obvious limitations thereto. Applicants respectfully submit that these clais are allowable over the cited references.

XV. Provisional Obviousness-Type Double Patenting Rejection Obviated In View of Amendments

Independent claim 1 and dependent claims 2, 3, 4, 5, 6, 8, 10, 13, 14, 19, 21 and 32 of the subject application are provisionally rejected under the judicially created doctrine of obviousness-type double patenting as being unpatentable over independent claim 24 and dependent claims 29, 31, 45, 34, 35, 36, 30, 38, 39, 41, 3 and 42 of Application No. 11/016,067 ("the '067 application"). The '067 application is a continuation-in-part of the subject application. The subject application and the '067 application are commonly owned by California Institute of Technology.

Applicants respectfully submit that the provisional rejection be withdrawn in view of amended claims and the differences between the amended claims and claims of the '067 application. Amended claim 1 recites "an ultra-high Q micro-cavity having a Q value of at least 1.00 x 10^8" whereas claim 24 of Application No. 11/016,067 currently does not. Further, claim 29 of the '067 application recites a "high Q value" rather than an "ultra high Q value" as recited in amended claim 1. Additionally, claim 24 of the '067 application recites limitations directed to "a sol gel solution" whereas amended claim 1 does not. Further, claim 24 of the '067 application includes a limitation "wherein the sol gel solution includes the dopant and at least a portion of the micro-cavity is coated with the doped sol gel solution… and has a wavelength influenced by the dopant in the sol gel coating" whereas amended claim 1 does not.

XVI. Conclusion

Applicants respectfully request that application is in condition for allowance. If there are any remaining issues that can be resolved by telephone, Applicants invite the Examiner to contact the undersigned at the number indicated below.

Respectfully submitted,

Date: April 7, 2006

By: ______________
Gary D. Lueck
Registration No. 50,791

BINGHAM MCCUTCHEN LLP
Three Embarcadero Center, Suite 1800
San Francisco, CA 94111
Telephone: (213) 680-6813
Facsimile: (213) 680-6499
E-mail: gary.lueck@bingham.com